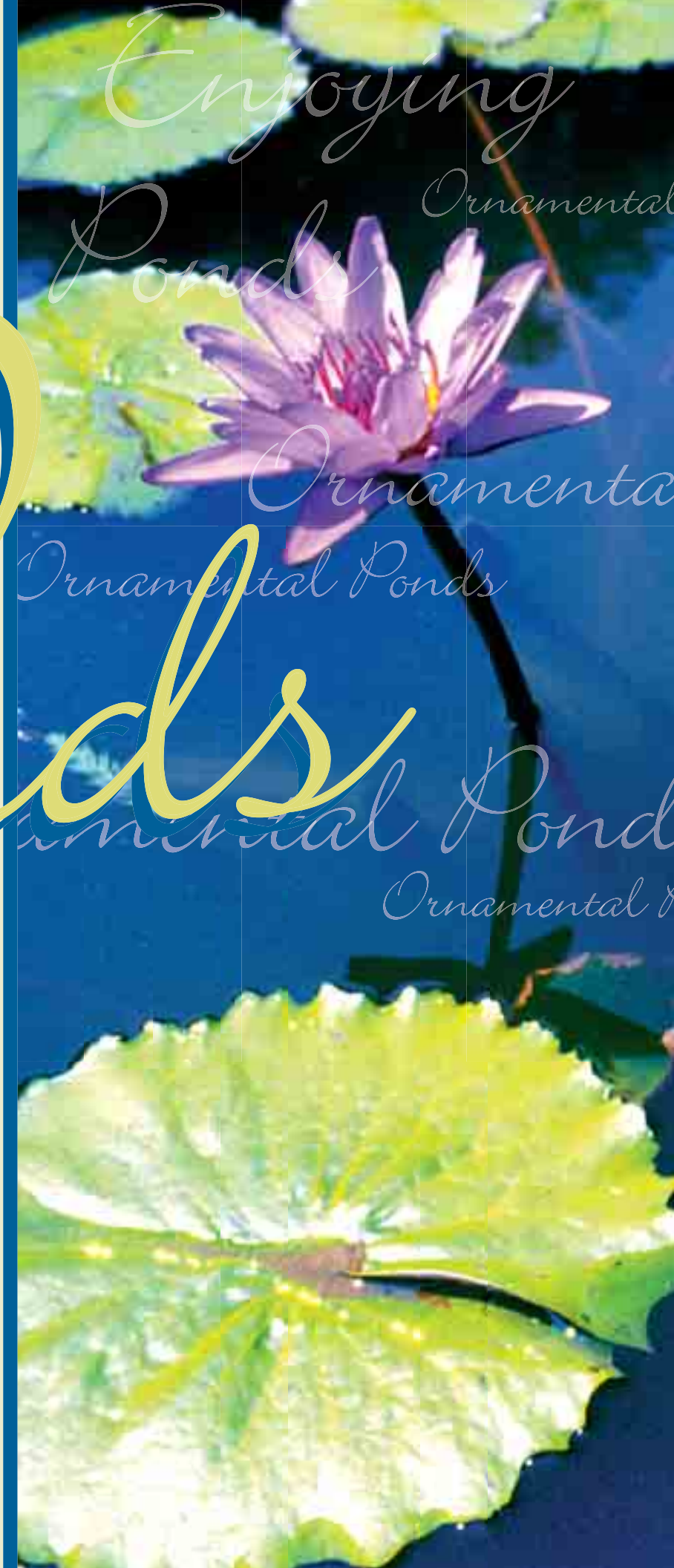
Enjoying Ornamental Ponds in Louisiana



LSU AgCenter
Research & Extension



Photographs on the front and back covers and pages 3, 5, 8, 12, 13, 17, were shot on location at Ewing Aquatech Pools, Baton Rouge, Louisiana. The photographs on pages 2 and 19 were taken at the LSU Rural Life Museum.

Enjoying Ornamental Ponds in Louisiana

Introduction



Water gardening is the fastest-growing gardening interest in the U.S. As this hobby grows in popularity, more pond-keeping products are becoming available at affordable prices. Unfortunately, more activity in water gardening has sometimes resulted in a lack of qualified guidance at the retail level in some areas.

This publication outlines some options for design, operation and maintenance of ornamental ponds and discusses basic environmental requirements of fish and plants commonly grown in these ponds. Since each ornamental pond is unique, these recommendations are general guidelines. Modify them to suit your particular pond.

Successful water gardening usually involves significant amounts of time, landscape area and money. Since changes later on can be difficult and costly, thorough planning is essential before you install a pond. Additional sources of information on water gardening include qualified nursery or pet store personnel, friends or neighbors with ornamental ponds, and numerous books on this subject.

Ornamental ponds generally fall into one of two types, garden ponds for the culture and display of aquatic plants or fish ponds for the culture and display of ornamental fishes. Some compromise between these two goals is usually possible, but priorities should be established early in the planning process.

Safety

Safety should always be a major concern. Be sure existing fences, gates, hedges, etc. are sufficient to prevent accidental drowning of small children. In some situations, sturdy wire mesh can be secured over the pond to keep small children out. This approach also keeps out falling sticks and branches where trees are present, as well as discouraging dogs or wild animals from using the pond for bathing and drinking. It's a good idea to contact your homeowner's insurance representative early in the planning process.

Another safety consideration is electrical service. Ground fault circuit interrupt devices are essential to prevent serious injuries from faulty wiring or equipment. Exposed wires on pumps or lights may go unnoticed if a pond liner is in place to act as an insulator. Fish will be unaffected and equipment may continue to function, but contact with the water by a person or animal will complete a circuit from the electrical source to the ground outside the liner, possibly resulting in electrocution if a ground fault interrupter is not in use.

All wiring should be rated for underground or underwater use and should be run underground, preferably in PVC pipe at a depth of 18 to 24 inches. Above-ground portions should be protected from accidental damage wherever possible.

Location

Don't place your pond too close to walls, fences or buildings. Local regulations or neighborhood bylaws may forbid ponds to be placed within some minimum distance from property lines. If possible, locate the pond near existing water and electricity service, but always contact local utility companies to locate water, gas, phone and electrical lines before digging. In Louisiana, most buried utilities can be located through the *Department of Transportation and Development.* Call "DOTTIE" at 1-800-272-3020.

From the standpoint of enjoyment, safety and discouraging predators, visibility of the pond should be considered when choosing a location. Avoid isolated areas where predatory birds and animals will be encouraged to visit. Also consider the prevailing wind direction, since it may be necessary to plant some shrubs upwind from the pond to prevent excessive turbulence.

Excess runoff from surrounding areas can be avoided by choosing a level site. Too much runoff may keep a pond cloudy, as well as introduce unwanted fertilizers or pesticides. To allow for drainage by siphoning or pumping, the pond site should not be too low. Avoid areas where pond runoff will end up on your neighbors' property.

Sunlight is one of the primary sources of oxygen in ornamental ponds, through the process of photosynthesis. As few as three to five hours of sunlight are sufficient for this purpose if aeration will be provided in the form of a waterfall or fountain. If keeping aquatic plants is the main objective, five to six hours of sunlight or more are needed daily.

Avoid direct sunlight at mid-day if possible. One partial solution to this problem is to plant large shrubs or a small tree on the southern side of the pond or build an arbor across the middle. If too few plants are present to take up excess nutrients from the pond water, intense sunlight will aggravate algae problems and may lead to oxygen depletions. Some problems with relying on large trees for shade include leaf litter, sap and other exuded substances, not to mention problems with or damage to tree roots for excavated ponds. Holly leaves, in particular, produce toxic substances if left to rot in the water. If shrubs or smaller trees cannot be properly located around the pond, floating plants can be a suitable source of shade.



Construction

A general rule for ornamental ponds is the larger the better, within the limits of space and budget. Even so, try to limit the pond width to 8-10 feet to allow fish to be observed.

Construction permits may be required in some areas, especially for larger projects. Check local building codes to find out what regulations apply to your particular project.

Take the time to lay out carefully where plumbing, electrical lines, pumps, lights, drains, filters, fountains, waterfalls and other pond features will be placed before you begin construction. A hose connected to the domestic water supply will usually be suitable as a water source except for very large earthen ponds, which may have to rely on rainfall runoff from the surrounding area. If possible, install an anti-siphon device on faucets or water lines supplying ornamental ponds.

Make sure the pond's shoreline will be level to avoid excessive exposure of interior walls, especially if a liner will be used. Excavated dirt can be used to solve this problem and can also be used to create interesting landscaping effects or support a waterfall or small stream. Ponds flush with ground level should be surrounded by a berm to prevent excessive runoff from lawns or gardens, especially in low areas. Topsoil can be set aside separately from clay subsoil for landscaping.

In Louisiana, ornamental ponds should be at least 18 inches deep. Fish health and water quality will usually benefit by including an area 36 inches or more in depth, especially if shade is limited. The deeper the pond, the less its temperature will fluctuate, benefiting both fish and aquatic plants. A deep area will also facilitate waste removal



and concentrate fish when emptying the pond. The rest of the bottom should slope to the deepest area.

Pond shape is important. Determine whether you want the pool to appear as a natural part of the landscaping or as a formal area to focus attention. This should be in keeping with the architecture of adjacent buildings and landscaping.

Just as irregular shapes lend themselves to natural landscapes, geometric shapes such as squares, rectangles or circles are more suited for formal pools. Avoid too many corners or zigzags if you will maintain high numbers of fish. Coordinate decorations with landscaping goals. Statues and ornate bird baths are more appropriate for formal pools; rocks and driftwood lend a more natural look to ornamental ponds.

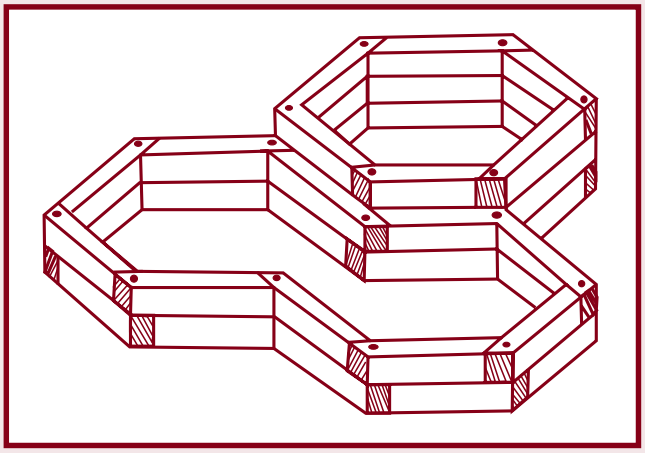
For earthen ponds or excavated ponds which will be lined, lay a rope or hose out on the ground to determine the exact shape and size you want before you start digging. Earthen ponds work best for large areas. High clay content soils are required for earthen ponds to avoid excessive water loss. Sides should not slope too gradually or nuisance vegetation may be hard to control. An overhanging rock border, while not required, can reduce wind erosion and enhance the pond's appearance.

Lined ponds use various materials to separate pond water from the underlying soils, improving water clarity and eliminating any possibility of water loss through percolation. Typical liner materials last from five to thirty years. Watch out for lining materials sold for swimming pools, general construction or other purposes. These materials may contain toxic compounds to prevent algae or mildew. Make sure the liner is safe for fish and plants before you buy it. Terraces (tiers) can be cut into the sides of lined ponds during excavation to provide ledges for potted plants and help prevent liners from slipping.

Rigid pre-formed ponds are available in a variety of plastic and fiberglass materials. Excavation for these types of ponds may require some trial and error to match the shape of the excavation with that of the pond. Drains may not be feasible for lined or rigid pre-formed pools, and draining is usually accomplished with a pump or siphon. An overhanging rock border is usually recommended for pre-formed ponds and pond liners to minimize exposure to sunlight and breakdown from ultraviolet rays.

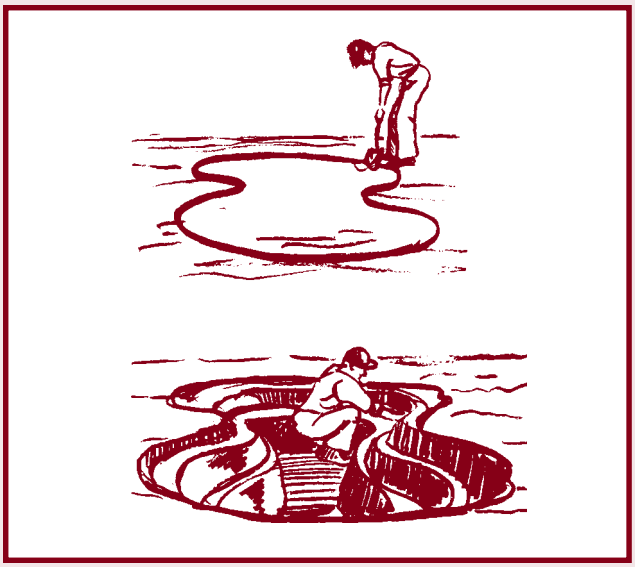
Although very durable, concrete ponds can be expensive. They may also experience problems with freezing if certain precautions are not taken during design and construction. Above ground ponds with lumber or concrete walls experience more extreme temperatures in winter and summer. This may cause problems for ornamental fish and plants. When considering an above ground pond or pool, avoid excessive weight on a patio slab or on soft or shifting soils.

For sizing pumps and filters, and other management purposes, it's important to know the volume of a pond in gallons. This value is easily calculated by multiplying the surface area in square feet times the average depth in feet times 7.5.



▲ *Landscape timbers with liners can be used to construct above ground ponds in any shape.*

▼ *Use a rope or garden hose to lay out your pond. Terraces should be dug out rather than filled in.*



Choosing and Installing a Pond Liner

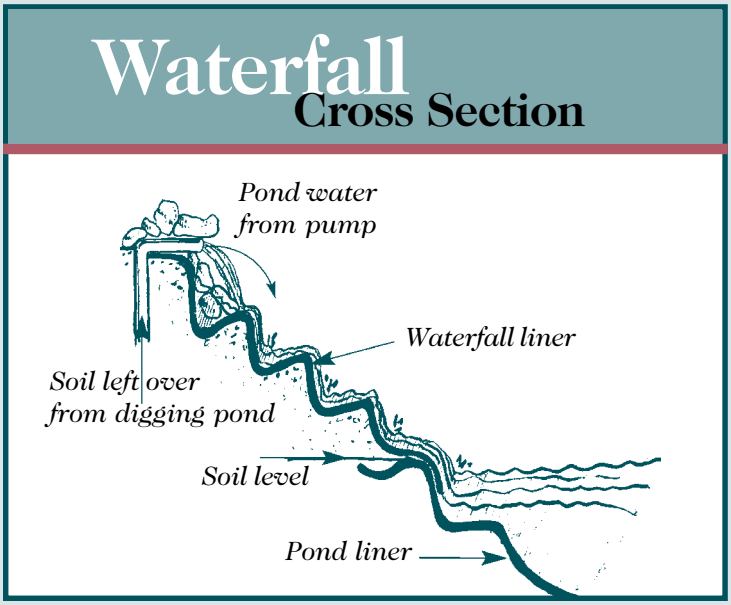
Using a length of rope or a garden hose, lay out the area you want the pond to occupy. Then decide on a depth. To determine the required length of the liner, add [the maximum pond length] plus [2 times the maximum pond depth] plus 3 feet. To determine the required liner width, add [the maximum pond width] plus [2 times the maximum pond depth] plus 3 feet.

Terraces (shelves) for plantings should be dug out rather than filled in. A trench 8 inches wide by 8 inches deep should be included around the entire pond to anchor the liner. Use a builder's level with a 2 by 4 to make sure the sides are level, then decide where overflow water will leave the pond. A good pond site will allow water to run away from the pond rather than into the soil under the liner.

Exposed roots, rocks or construction debris must be removed from the bed of the pond to prevent seepage or liner punctures. A protective

underlining of old carpet or blankets will help protect the liner from accidental punctures. Work out from the center when laying the liner in place. Don't pull it out by the edges if it can be avoided. Some folds and wrinkles will usually be necessary, but they are no cause for concern.

Fill the pond slowly, but almost completely, before trimming and burying the liner edges under plants and/or rocks in the trench surrounding the pond. Overhanging rocks, coving or wooden borders will be needed to prevent sunlight from breaking down exposed portions of the liner around the pond banks.



Building a Waterfall

Use soil from the excavation to build a large, well-packed mound. Depending on the soil type, several days or weeks may be required for settling, although slight settling should not affect the final product. Next, carve out the path that the water flow will follow to a depth of 8 to 10 inches, cutting in steps for splashing from rock to rock. The more steps you can include, the more oxygen you will add to the water. Steps should slope downward into the mound to create a 4-inch-deep pool at each level.



To determine the length of liner material you will need, measure the total course of the waterfall without breaking contact from the soil, including the vertical surfaces of the steps that have been carved out, and add 2 feet. Next, measure the width along the widest point and add 3 feet to determine the required liner width.

Place stones along the walls of the waterfall channel to support and anchor the liner. Overhanging rock can then be placed along the sides of the channel to hide the liner edges. Slate, gravel and small rocks can be placed in the channel to hide the liner completely, if desired. The waterfall liner should directly overlap the pond liner where the flow returns to the pool. Before placing the final layer of slate or stone at the foot of the waterfall, make minor adjustments to support the walls of the channel as they meet the pond edge.

Place the pump to drive the waterfall at the far end of the pond. From there, the water can be run by a hose or pipe concealed below the water surface and under the rock work or below the soil surface along the side of the pond and up to the top of the waterfall mound.

Water Sources

Water hardness is a major consideration for ornamental fish ponds. Soft water can be stressful for goldfish and koi. If your water supply is very soft, add 1/4 pound of table salt, 1/4 pound of dolomitic garden lime (in the white powdered form) and 6 tablespoons of bicarbonate of soda for every 100 gallons of water. If sensitive ornamental plants will be in the ponds, skip the salt and double the amount of garden lime. Remember that pond length by width (surface area) by average depth times 7.5 equals the approximate number of gallons to be treated.

Hard water sources often contain high levels of iron, which can cause unsightly conditions in ornamental ponds and even damage fishes' gill tissues. If your water supply comes from a well that contains excessive amounts of iron, it may be necessary to aerate the water vigorously in containers such as garbage cans and allow the iron particles to settle for several days.

Domestic water supplies and well water usually contain little or no oxygen, but vigorous aeration or spraying through a hose nozzle will usually raise dissolved oxygen concentrations to acceptable levels. Surface water from canals, ditches or larger ponds is not recommended since these sources may contain parasites, diseases, wild fish, pesticides or unwanted turbidity.

Municipal water supplies usually contain chlorine or chloramine to control bacteria and other potential pathogens. One week of storage is usually sufficient to remove chlorine but if your water contains chloramine use dechlorinators available from pet shops or nurseries that stock pond-keeping supplies.

Water Exchanges

If few or no fish are present, water exchanges will not be needed. Otherwise, a good rule is to replace 10 percent of the pond water every two weeks or 25 percent once a month. Avoid changing more than 25 percent of the pond volume at a time. In general, chemicals and minerals should be added to replacement water at the same rates as when the pond was originally filled. Skip the addition of salt and/or dolomitic lime every fourth exchange to avoid an accumulation of minerals caused by evaporation.

Aeration and Filtration

If the proper balance between fish and plants can be achieved in an ornamental pond, plants will take up excess nutrients. Algae problems will be avoided and cleaning will rarely be needed. A proper balance usually means lots of plants and very few fish. Ornamental ponds rely on natural processes to break down and use nutrients, but if more than a few fish are to be maintained in good health, these processes must be accelerated and supplemented through aeration and filtration. Although they are two separate processes, they will be discussed together since the same equipment can be used to achieve these goals simultaneously.

When more than a few fish are present, food must be provided. The fish, in turn, excrete ammonia as a waste product. Another source of ammonia in ornamental ponds is the natural breakdown of uneaten feed and decaying plant material. Excessive ammonia can be toxic to fish, but plants (including algae) use ammonia to support growth. In natural ponds, certain species of bacteria break down ammonia into nitrite, another toxic compound, and then into nitrate, which is relatively harmless to the fish. Nitrate, however, is also a source of fertilizer for plants and algae, although it is less potent.

Biological filters rely on pumping water across beds of gravel, plastic mesh, plastic sheets, rubber foam or other materials with high surface areas. The bacteria that break down ammonia colonize these surfaces, allowing much greater rates of breakdown than would occur in the pond itself. Once a biological filter is installed, it usually takes six to ten weeks for the bacterial populations to become fully established. Unfortunately, if the water flow is interrupted for too long (anywhere from twenty minutes to two or three hours, depending on the filter design), most of the bacteria will die and the filter will need to be re-established.

A biological filter should provide high surface area while allowing water to pass without clogging. For this reason, sand, fine gravel and foam should be avoided in biological filters, even though they perform well in some mechanical filters. Perhaps the best materials for use inside biological pond filters are commercially available plastic rings or balls, but these can be expensive. An economical alternative is 1- to 2-inch lava rock. Lava rock is lighter than ordinary stone and provides significantly more surface area for bacteria to colonize.

A general rule for sizing a biological filter is to divide the pond volume in gallons by 125 to give the recommended filter volume in cubic feet. For example, a 250-gallon pond will require 2 cubic feet of lava rock in a biological filter. Once the required volume of the biological filter is determined, the only remaining consideration is to limit the depth of the media to roughly 18 inches. Containers used for biological filters should keep out sunlight to prevent algae growth on the media inside.

Whatever the filtration design, the pump should be sized to turn over the pond volume every three to four hours. If water flows too quickly, howver, bacteria tend to be scoured off, reducing the filter efficiency. When pricing pumps with comparable flow rates, keep in mind that a pump with lower wattage may result in considerable savings over time. Operating cost comparisons may be made by dividing the rated wattage by 1000 to calculate kilowatt demand and then multiplying by 720 hours per month to estimate kilowatt hours per month. Of course, you'll need to know the cost per kilowatt hour your local utility service charges.

Another problem associated with biological filter efficiency is the loss of too many bacteria during cleaning. Ammonia breakdown may be depressed for several days if the cleaning process removes or destroys too much of the bacterial population. Ideally, a dual set of biological filters can be installed, allowing alternate cleaning or backflushing. This may also allow sufficient time between cleanings for the establishment of other naturally occurring bacteria which take up phosphorus, further limiting the nutrients available to support algal blooms.

Water that has passed through a biological filter usually has low dissolved oxygen levels, since the bacteria require oxygen to break down ammonia to nitrate. This problem is easily solved by incorporating a waterfall for aeration as the water returns to the pond. Placing the filter outside of and above the pond will also make cleaning and flushing much easier. Plumbing should be provided, however, to allow water from the pump to be diverted directly back to the pond during periods of extreme cold, to prevent ice formation in the filter and on the pond surface.

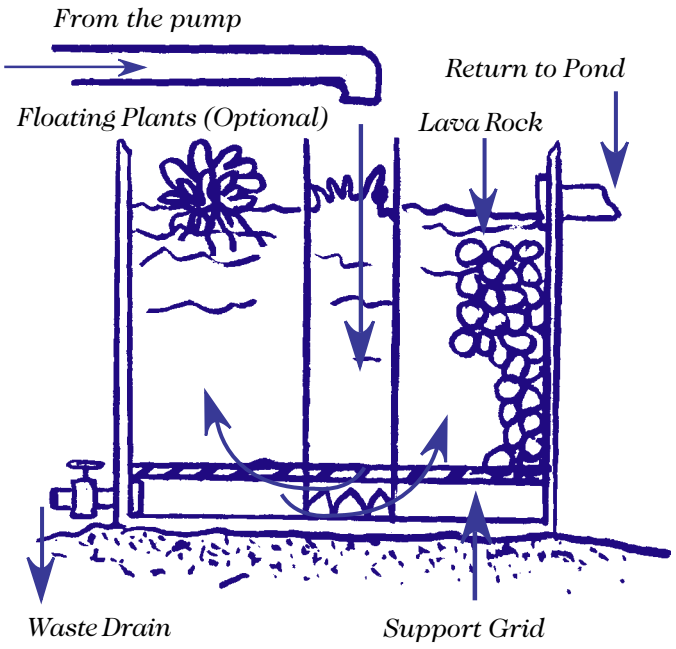
If large amounts of uneaten feed and plant debris tend to accumulate within the pond, use mechanical filtration to remove these materials before they decompose into ammonia and other

excess nutrients. All mechanical filters and most biological filters require regular cleaning. Some designs combine both types of filtration into a single unit. Certain types of mechanical filters such as cartridge filters and sand filters should be avoided because of frequent clogging and/or significant water loss during backwashing. A general rule is that the finer the particles removed, the more frequently the filter must be cleaned or backwashed. Only a few possibilities are shown here.

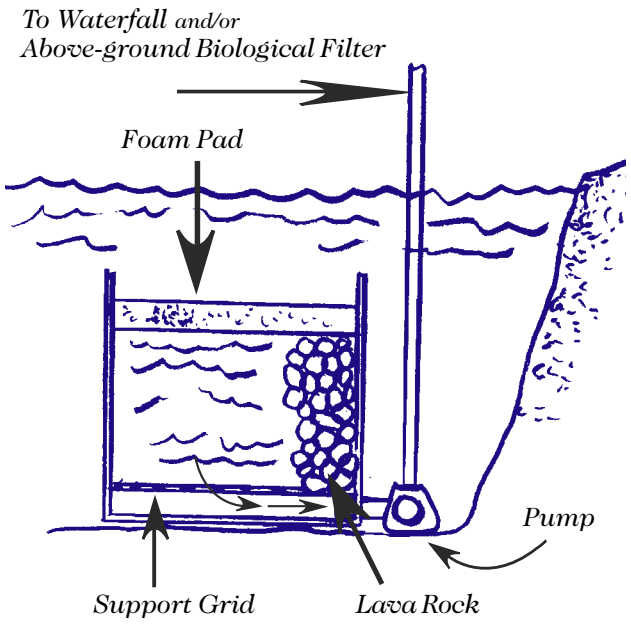
A swimming pool sand filter may be appropriate for large ponds, but coarse sand will be required. Problems with these filters sometimes include pump noise and high electricity consumption, high water consumption in backflushing and the eventual need to replace the filter sand.



Upflow Biological Filter



Submerged Biological Filter



Algae and Oxygen Problems



Although oxygen depletions usually result when algae blooms become too thick, they can also occur in relatively clear water. In either case, the same conditions usually lead to these problems. Primary reasons for oxygen depletions, with or without excessive algal blooms, include overfeeding or excessive amounts of decomposing plants or fish wastes. These problems usually cause ammonia levels to increase, placing additional stress on the fish.

Algae require dissolved nutrients and sunlight to thrive. Controlling one or both of these factors should help reduce problems with algal blooms. If excess nutrients cannot be tied up in plants or removed by filtration, suspended algae will saturate the water, imparting a green, soupy color. This problem can occur even with biological filtration if there aren't enough plants in the pond to use the nitrates that accumulate from the breakdown of ammonia. Flushing a pond to remove algae may not solve the problem, since many water supplies contain phosphorus, a primary nutrient for algal blooms.

Too much algae will limit observation of fish and often results in oxygen problems. Suspended algae, like all green plants, produce oxygen in the sunlight through photosynthesis and consume part of that oxygen in the night. Oxygen problems are especially prevalent during the summer, because as water becomes warmer its capacity to hold oxygen in solution decreases. Under these conditions, most of the oxygen produced during daylight hours leaves the water rapidly and is not available to satisfy night-time oxygen requirements.

Fish gasp at the water's surface during the early stages of an oxygen depletion. At this point, the only solution is emergency aeration. This can be accomplished by applying a fine spray from a garden hose at high volume. Add a dechlorinator if high volumes of chlorinated water are added to the pond.

After the immediate problem has been corrected, you must prevent recurrence of an oxygen depletion. Appropriate steps may include flushing the pond with clean water (dechlorinated and adjusted for hardness if necessary), removing some of the fish population, adding continuous aeration by a fountain or waterfall, cleaning the pond to remove decomposing materials or using a combination of several of these procedures.

Continuous aeration will not prevent or correct an algal bloom, but it will counteract the tendency toward oxygen depletions. Aeration will benefit the overall health of the pond by accelerating the breakdown of ammonia and can be easily incorporated in decorative features such as waterfalls and fountains.

Fish



Goldfish are domesticated varieties of the Asian carp *Carassius auratus*, which have been selectively bred for many centuries. Some varieties live for as long as 20 years. Koi carp are highly selected strains of the common carp, *Cyprinus carpio*. Koi may live for 50 years or longer, if properly cared for. Although goldfish and koi both originated in China, most of the development of ornamental strains has occurred in Japan during the past 200 years.

Where aquatic plants will be the main attraction, koi should be avoided since they are more inclined to damage vegetation than their cousins, the goldfish. Various types of goldfish and koi can be successfully maintained together in ornamental ponds, but fancy goldfish often have difficulty competing for food with their more streamlined relatives. Smaller or slower fish may also suffer injuries from larger fish during the spawning season. The first questions many pond owners raise concerning fish are how many and how big? Under natural conditions, a pond supports the fish by supplying oxygen, breaking down wastes and providing natural food. As pointed out, each of these factors can be increased artificially, to some extent, if the primary goal is to maintain large numbers of fish. Some guidelines to begin with in ponds without aeration are: One inch of fish per 8 gallons of water, or 1 inch of fish per square foot of surface area.

The greater the load of fish in the pond, the greater the chances for water quality problems and disease outbreaks.

Ponds should be filled for at least two weeks before stocking. Most pond keepers begin with too many small fish, which can result in several problems. Initially, only one or two fish should be introduced into a pond to allow time for a natural chemical and biological balance to become established. If too many fish are added shortly after the pond is filled, the ammonia they produce may rise to critical levels before the bacteria that break it down can become established.

When too many small fish are stocked into a pond, the fish eventually grow to a size where the natural capacity of the pond to support them is exceeded. Then, oxygen or disease problems can begin without warning. A 6-inch koi will eventually grow to 18 inches if sufficient food, oxygen and living space are provided. This is an increase in weight from just over 2 ounces to roughly 44 ounces. In just two years, a one-year-old koi can increase its weight by a factor of 10.

Another cause of overcrowding is reproduction. As spawning approaches in the early spring, male goldfish develop small bumps on their gill covers and their pectoral (side) fins. Females become much rounder and fuller. Once spawning begins, one or several males will chase a female as she begins to shed eggs, literally bumping her into the sides of the pond and other

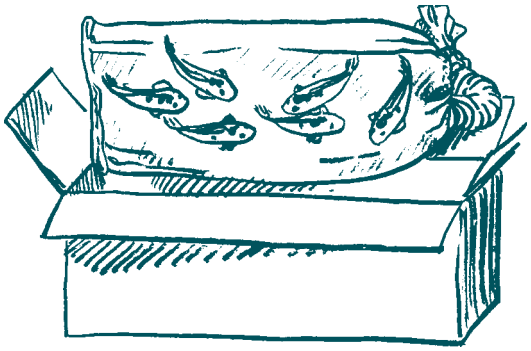
solid objects or plants. For this reason, slow or small females may sustain serious or fatal injuries. This problem is especially prevalent when koi and goldfish occupy the same pond, since koi and goldfish often interbreed or attempt to do so.

Even if fingerling survival rates are low, after several years of reproduction the fish load in an ornamental pond can increase significantly. Excess fingerlings must be removed from the pond each year. If some young fish are kept, they should be selected for coloration. Remove sufficient numbers of older fish to make room for them.

Stocking New Fish

If fingerlings arrive in sealed plastic bags, float the bags in a shady area for 30 minutes, then open them and release the fish immediately. Pond water should not normally be mixed with shipping water in bags because carbon dioxide and ammonia build up in shipping bags during transport. Since these compounds cannot dissipate into the atmosphere, dissolved carbon dioxide reaches very high levels, lowering the pH of the shipping water. Opening the bags allows the carbon dioxide to escape rapidly, and aerating or splashing accelerates this process. The pH rises drastically, and any ammonia present rapidly converts to the toxic form, killing small fingerlings quickly.

This problem is less serious when transport times are short and when fish have not been fed for several days. Gradual mixing of pond water with transport water in bags (after temperature adjustment) is usually desirable only when moving young fish from hard water to moderately or very soft water. When attempting this procedure, monitor the fish closely for signs of stress, and introduce them directly into the pond if they appear weak or disoriented.



Let the bag of fish sit in the water at least 30 minutes.



Feeding

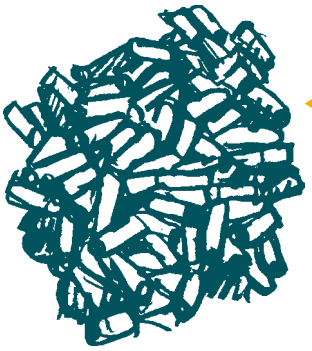
Feed is the major source of nutrients entering a pond stocked with fish. These nutrients eventually end up in the fish, in fish waste or in uneaten feed which decomposes within the pond. If fish wastes and uneaten feed accumulate faster than plants can use them, oxygen and algae problems are guaranteed to follow.

Use a high-quality feed with at least 30% protein. Higher protein levels are especially important for young fish or when feed must be limited to slow fish growth or maintain suitable water quality. Never buy more than a month's supply of food, and keep all but one week's worth in a refrigerator to maintain freshness. Vegetable scraps such as spinach, lettuce or peas can supplement the regular diet but meat scraps should never be offered.

Another important rule to remember is that the smaller the pellet diameter, the easier it will be for the fish to digest. Occasionally, large pellets can be swallowed before they have a chance to absorb water. These pellets subsequently swell inside the fish, often causing a blockage of the intestine which can be fatal.

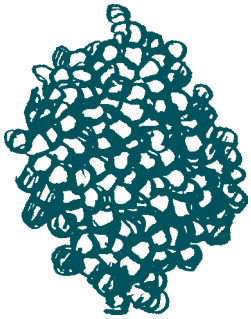
How much food is enough? This will depend principally on the water temperature. If the pond temperature is below 50 degrees Fahrenheit, no feeding is necessary. From 55 to 65 degrees, two feedings per day over 5 to 10 minutes should be sufficient. If all of the food is not consumed within 10 minutes at this temperature, you are feeding too much and uneaten feed should be removed. As water temperatures rise above 70 degrees, up to five feedings per day are allowable, but none should exceed 3 to 5 minutes. Any feed remaining after 5 minutes should be removed. If no aeration is present, limit feeding to a period beginning at mid-morning and ending in the late afternoon.

Often, fish appetites will drop off after a rapid decrease in temperature. If appetites decline for no apparent reason, oxygen levels may not be sufficient or a disease problem may be beginning.



Koi Sticks

Color Pellets

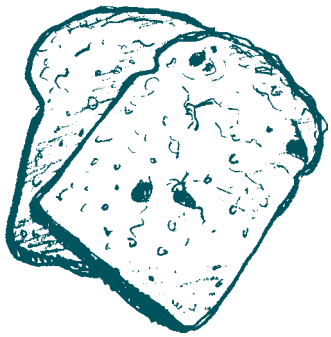




Peas

Lettuce





Bread

Diseases

All common fish diseases are influenced by stress. Major forms of stress are low oxygen levels and poor water quality (ammonia accumulation). Both are preventable through good management and maintenance. Other causes of stress are harder to control, such as rapid drops in temperature, physical damage from spawning activities and handling when cleaning a pond or moving fish. Whenever possible, the underlying cause of stress should be identified and corrected to avoid problems in the future.

Once disease outbreaks occur, options are usually limited. Some therapeutic chemicals are available through pet stores, but this approach is usually hit-or-miss unless a reliable diagnosis of the disease can be obtained. In Louisiana, sick fish can be submitted to the LSU School of Veterinary Medicine. Ask your Louisiana Cooperative Extension Service office for Publication 2470, "Submitting Samples for Fish Disease Diagnosis." Symptoms to watch for that may help in identifying a disease problem include a reduction in appetite, rubbing on pond walls or other objects as if in response to an itch, sores or bruises on the skin, erratic swimming and hovering at the surface.

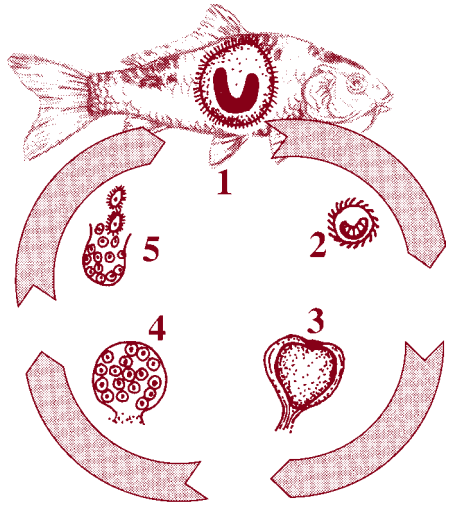
Nuisance animals

Avoid isolated locations where predatory birds, animals, vandals or thieves will be encouraged to visit. Small birds and other desirable wildlife may be welcome guests at ornamental ponds, but species such as raccoons, otters, snakes, wading birds, turtles and even frogs can cause serious problems and should be discouraged or physically excluded from the pond. Turtles can eat valuable plants, and frogs and toads may lay tremendous numbers of eggs in the pond, producing tadpoles that consume oxygen and harbor diseases.

In some cases, netting or sturdy wire mesh over the pond may be required to keep out predators. Although these materials tend to obstruct viewing, if black netting or darkly coated mesh is available the problem will be minimized. A moderately successful alternative to keep frogs out of small ponds is ornamental fencing about 12 inches in height.



White Spot Disease



1. *Individual cells beneath the skin.*
2. *Mature parasites 'punch' out and swim away.*
3. *Parasites become enclosed in a gelatinous capsule.*
4. *Each cell divides to form 1000 or more infective stages.*
5. *'Swarmers' must find a host in 24 hours.*

Note: *Treatments added to the water are effective only against the free swimming stages.*

Annual Cleaning

While spring cleaning seems to be the rule around most homes, fall cleaning is preferable for ornamental ponds. Cleaning in the fall minimizes ammonia concentrations during the winter when cold water slows down the bacteria that normally break it down. Pick a day that is not too hot or too cool, but remember that lower temperatures usually result in less stress for the fish.

Do not feed fish for two or three days before removing them from the pond. During the cleaning procedure, fish can be held in clean coolers, garbage cans or other containers that have been thoroughly rinsed of any soap or chemical residues. Provide shade in your holding area. Holding water should be a mixture of equal parts of pond water and fresh new water. This new water should be dechlorinated and treated just like water that would be used for water exchanges or filling the pond. Finally, add an additional 8 level tablespoons of food grade salt per 10 gallons of holding water.

Provide as much room per fish as you can, and use an air pump or water pump to provide aeration in each container. If aeration is not possible, use broad, shallow containers to maximize the available surface area.

Cover holding containers loosely to prevent fish from jumping out. Small-mesh netting can serve this purpose well if it is tightly secured. Don't use clear plastic. This can cause the water temperature to rise, reducing the oxygen-holding capacity.

Plants should also be kept in the shade. Keep underwater plants in buckets of pond water. Emergent plants can be kept moist using wet newspaper and/or plastic bags.

The pond should be drained or pumped out to the point where sludge and debris can be mechanically removed. Dustpans or large plastic cups are useful for scooping out sludge. Pond walls should not be scrubbed, just rinsed. Attached algae will compete with algal blooms for nutrients and improve water clarity. This is also a good time to clean the pump intake.

Annual Cleaning
Suggested Equipment List

1. Nets to catch fish
2. Holding containers for fish
3. Submersible pumps or air pumps with airstones to aerate holding containers
4. Buckets to carry fish and hold submerged plants
5. Newspapers and plastic bags to store potted plants
6. A submersible pump with extra pipe or hose
7. A water test kit
8. Water conditioning chemicals (dechlorinators and minerals)
9. Cleaning brushes or pads for pumps, statues and rocks
10. Supplies for repotting plants
11. An aquarium or pool thermometer
12. Boots

Plants

Plants are important in ornamental ponds, both for their aesthetic attributes and their ability to take up nutrients. Lots of plants are essential for clean, clear water. If no fish are to be kept in the pond, some source of nutrients, usually available from nursery or pond suppliers, must be provided to support plant growth.

In this situation, however, mosquitoes often breed excessively and mosquito fish, or topminnows, may have to be introduced from nearby ditches to control the problem. A few goldfish can usually be added to a garden pond for this purpose without any requirement for feed or maintenance and with little adverse impact on the plants.

Some floating plants can be added when setting up a garden pond and later thinned out as they multiply. Water lilies, in pots, can cover up to 3/4 of the surface. Use 1 inch of gravel or small stones above the soil in pots, especially if fish will be present.

One point to consider is that many fish, especially koi, are prone to nibble on plants, so stems, roots and leaves may need to be protected with coated wire or plastic mesh. Mesh size should be roughly 1/2 inch to provide maximum protection. In some situations, it may make sense to fence off part of the pond with plastic mesh to separate fish from delicate plants.

Sagittaria and *elodea* (also called anacharas) are excellent choices for submerged beds and are often marketed as oxygenating plants. They usually do not require pots, but simply grow and multiply by removing dissolved nutrients from pond water. They require moderate to full sunlight, however, to prosper and produce oxygen. These plants do an excellent job of maintaining water clarity, but they require occasional thinning to prevent the entire pond from being overrun.

Floating plants such as water lettuce and water hyacinth provide shade and will take up some nutrients, but their filtering capabilities are best in shallow, moving water. For this reason, they are often incorporated in certain types of biological or mechanical filters. Many plants, especially floating plants, produce excessive amounts of debris as their leaves and stems mature and are shed. This debris



can clog pumps and filters and serve as an additional source of ammonia, which must be removed by other plants or through biological filtration. Remove dead and dying foliage often to improve the pond's appearance and maintain good water quality.

Many non-native aquatic plants find their way into ornamental ponds through commercial outlets. Some can be collected from local waters. Unfortunately, several of these species can pose serious threats as potential invaders of aquatic habitats throughout the state. Aquatic plants such as hydrilla or giant salvinia spread rapidly, crowding out important native species and choking lakes and waterways. To prevent any chance of accidental introduction into natural habitats, plants should always be composted or dried completely when excess vegetation is removed.

Even in Louisiana, many popular pond plants cannot survive the winter and must be brought indoors or cut back in the fall. Nursery specialists can suggest which types of plants will be best suited for your particular pond. ■





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